

What Is Claimed Is:

1. An image sensing apparatus comprising:  
image sensing means for converting an optical  
5 image into electric signals and outputting the electric  
signals as image signals;  
shifting means for shifting an image formation  
position of the optical image formed on said image  
sensing means to a plurality of different positions;  
10 first vibration detection means for detecting  
vibration of the image sensing apparatus and outputting  
vibration information;  
control means for controlling said shifting means  
on the basis of the vibration information outputted by  
15 said first vibration detection means; and  
image signal synthesis means for synthesizing  
image signals of a plurality of images outputted by  
said image sensing means to generate a single image,  
wherein said image sensing means converts the  
20 optical image into electric signals at each of the  
plurality of different image formation positions  
shifted by said shifting means.
2. The image sensing apparatus according to  
25 claim 1, wherein said control means comprises:

DETAILED DESCRIPTION

pixel shifting control data generation means for generating pixel shifting control data for controlling said shifting means in pixel shifting operation;

- vibration compensation data generation means for 5 generating vibration compensation data for compensating the vibration on the basis of the vibration information outputted by said first vibration detection means; and control data synthesis means for synthesizing the pixel shifting control data and the vibration 10 compensation data to generate a control signal for controlling said shifting means.

3. The image sensing apparatus according to claim 2 further comprising optical system state 15 detection means for detecting a state of at least one of a zooming optical system and a focusing optical system,

wherein said control means further comprises data correction means for correcting at least one of the 20 pixel shifting control data and the vibration compensation data in accordance with the state detected by said optical state detection means.

4. The image sensing apparatus according to 25 claim 3 further comprising storage means for storing first correction data for correcting the pixel shifting

control data and second correction data for correcting  
the vibration compensation data,

wherein said data correction means reads at least  
one of the first and second correction data,

- 5 corresponding to the state detected by said optical  
state detection means, stored in said storage means,  
and performs at least one of an addition of the read  
first correction data to the pixel shifting control  
data and an addition of the read second correction data  
10 to the vibration compensation data.

5. The image sensing apparatus according to  
claim 1, wherein said shifting means is a movable  
optical means.

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6. The image sensing apparatus according to  
claim 1, wherein said shifting means is a plane  
parallel plate.

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7. The image sensing apparatus according to  
claim 1, wherein said shifting means is a variable  
apical angle prism.

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8. The image sensing apparatus according to  
claim 1, wherein said control means comprises change-  
over means for changing between a plurality of pixel

shifting modes, and pixel shifting control data generation means for generating pixel shifting control data for controlling said shifting means in pixel shifting operation,

5       wherein said change-over means changes the pixel shifting modes on the basis of the vibration information outputted by said first vibration detection means.

10      9. The image sensing apparatus according to claim 8, wherein the pixel shifting modes indicate number of the image formation positions to be shifted in pixel shifting operation, and said change-over means selects a first number of image formation positions  
15     when a degree of vibration indicated by the vibration information is equal or less than a first predetermined value; and selects a second number of image formation positions which is smaller than the first number when the degree of vibration is larger than the first  
20     predetermined value.

10. The image sensing apparatus according to claim 9, wherein said change-over means selects a third number of image formation positions which is smaller than the second number when the degree of vibration is  
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larger than the second predetermined value which is  
larger than the first predetermined value

11. The image sensing apparatus according to  
5 claim 8 further comprising optical system state  
detection means for detecting a state of at least one  
of a zooming optical system and a focusing optical  
system,

wherein said control means further comprises data  
10 correction means for correcting the pixel shifting  
control data in accordance with the state detected by  
said optical state detection means.

12. The image sensing apparatus according to  
15 claim 11 further comprising storage means for storing  
correction data for correcting the pixel shifting  
control data,

wherein said data correction means reads the  
correction data, corresponding to the state detected by  
20 said optical state detection means, stored in said  
storage means, and performs an addition of the read  
correction data to the pixel shifting control data.

13. The image sensing apparatus according to  
25 claim 1, wherein said control means comprises change-  
over means for changing between a plurality of pixel

shifting modes, and pixel shifting control data generation means for generating pixel shifting control data for controlling said shifting means in pixel shifting operation,

5 wherein said change-over means changes between the pixel shifting modes in accordance with a user designation.

14. The image sensing apparatus according to  
10 claim 13 further comprising optical system state detection means for detecting a state of at least one of a zooming optical system and a focusing optical system,

wherein said control means further comprises data  
15 correction means for correcting the pixel shifting control data in accordance with the state detected by said optical state detection means.

15. The image sensing apparatus according to  
20 claim 14 further comprising storage means for storing correction data for correcting the pixel shifting control data,

wherein said data correction means reads the  
25 correction data, corresponding to the state detected by said optical state detection means, stored in said

storage means, and performs an addition of the read correction data to the pixel shifting control data.

16. The image sensing apparatus according to  
5 claim 1 further comprising second vibration detection means for detecting blurring in an image on the basis of the image signals outputted by said image sensing means and outputting blurring information,

wherein said control means controls said shifting  
10 means on the basis of the vibration information outputted by said first vibration detection means and the blurring information outputted by said second vibration detection means.

15 17. The image sensing apparatus according to  
claim 16, wherein said first vibration detection means is a vibration-type gyro and said second vibration detection means is movement vector detection means.

20 18. The image sensing apparatus according to  
claim 1 further comprising photometry means and luminous exposure adjustment means for determining a luminous exposure on the basis of a result of the photometry performed by said photometry means and  
25 controlling said image sensing means to use the determined luminous exposure.

19. The image sensing apparatus according to  
claim 18, wherein, when the image formation position is  
shifted by said shifting means, said luminous exposure  
adjustment means determines a different luminous  
exposure and controls said image sensing means to use  
the different luminous exposure.

20. The image sensing apparatus according to  
claim 19, wherein said photometry means performs  
photometry on each of a plurality of divided areas of  
an image sensed by said image sensing means.

21. The image sensing apparatus according to  
claim 20 further comprising main object determination  
means for determining a divided area which includes a  
main object among the plurality of divided areas,  
wherein said luminous exposure adjustment means  
controls said image sensing means to use a first  
luminous exposure which is suitable for the divided  
area including the main object, which is determined by  
said main object determination means, and to use at  
least one of second and third luminous exposures where  
the second luminous exposure is larger than the first  
luminous exposure and the third exposure is smaller  
than the first luminous exposure.

22. The image sensing apparatus according to  
claim 18, wherein said luminous exposure adjustment  
means adjusts the luminous exposure by changing  
5 exposure time.

23. The image sensing apparatus according to  
claim 18, wherein said luminous exposure adjustment  
means adjusts the luminous exposure by changing  
10 aperture of an iris diaphragm.

24. The image sensing apparatus according to  
claim 18, wherein said luminous exposure adjustment  
means adjusts the luminous exposure using an  
15 electrochromic element.

25. The image sensing apparatus according to  
claim 21, wherein said control means comprises change-  
over means for changing between a plurality of pixel  
20 shifting modes, and pixel shifting control data  
generation means for generating pixel shifting control  
data for controlling said shifting means in pixel  
shifting operation,

wherein said change-over means changes the pixel  
25 shifting modes on the basis of the vibration  
information outputted by said first vibration detection

means, and said luminous exposure adjustment means determines the luminous exposure to be used in said image sensing device on the basis of the pixel shifting mode selected by said change-over means.

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26. The image sensing apparatus according to claim 25, wherein the pixel shifting modes indicate number of the image formation positions to be shifted in pixel shifting operation, and said change-over means  
10 selects a first number of image formation positions when a degree of vibration indicated by the vibration information is equal or less than a first predetermined value; selects a second number of image formation positions which is smaller than the first number when  
15 the degree of vibration is larger than the first predetermined value and equal or less than a second predetermined value which is larger than the first predetermined value; and selects a third number of image formation positions which is smaller than the  
20 second number when the degree of vibration is larger than the second predetermined value.

27. The image sensing apparatus according to claim 21, wherein said control means comprises change-over means for changing between a plurality of pixel shifting modes, and pixel shifting control data  
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generation means for generating pixel shifting control data for controlling said shifting means in pixel shifting operation,

wherein said change-over means changes between the  
5 pixel shifting modes in accordance with a user designation and said luminous exposure adjustment means determines the luminous exposure to be used in said image sensing device on the basis of the pixel shifting mode selected by said change-over means.

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28. The image sensing apparatus according to  
claim 1 further comprising blurring detection means for  
detecting relative blurring amount between two images  
out of a plurality of images obtained at the plurality  
15 of image formation positions shifted by said shifting  
means by comparing image signals of the two images, and  
outputting the blurring amount.

29. The image sensing apparatus according to  
20 claim 28, wherein said blurring detection means detects  
the relative blurring amount by comparing the image  
signals of the two images which are obtained in series  
out of the plurality of images obtained at the  
plurality of image formation positions.

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30. The image sensing apparatus according to  
claim 28, wherein said blurring detection means detects  
the relative blurring amount by comparing the image  
signals of the two images which are obtained at the  
same image formation position in series out of the  
plurality of images obtained at the plurality of image  
formation positions.

15 31. The image sensing apparatus according to  
claim 28 further comprising disabling means for  
disabling the image signal synthesis means in a case  
where the blurring amount detected by said blurring  
detection means is greater than a predetermined value.

20 32. The image sensing apparatus according to  
claim 31 further comprising notification means for  
notifying a user of image synthesis being disabled in a  
case where said disabling means disabled said image  
signal synthesis means.

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33. The image sensing apparatus according to  
claim 31, wherein said image signal synthesis means has  
a plurality of image synthesis modes, and selects one  
of the plurality of image synthesis modes in accordance  
with the blurring amount.

34. The image sensing apparatus according to  
claim 33, wherein the image synthesis modes indicate  
numbers of images to be synthesized out of the  
plurality of images sensed by said image sensing means,  
5 and said image signal synthesis means selects a first  
number of images when the blurring amount is equal or  
less than a first predetermined value; and selects a  
second number of images which is smaller than the first  
number when the blurring amount is larger than the  
10 first predetermined value.

35. The image sensing apparatus according to  
claim 34, wherein said image signal synthesis means  
selects a third number of images which is smaller than  
15 the second number when the blurring amount is larger  
than the second predetermined value which is larger  
than the first predetermined value.

36. The image sensing apparatus according to  
20 claim 34 further comprising notification means for  
notifying a user of the image sensing mode selected by  
said image signal synthesis means.

37. The image sensing apparatus according to  
25 claim 28, wherein said image signal synthesis means  
synthesizes the image signals of the plurality of

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images on the basis of the blurring amount detected by said blurring detection means so that blurring is compensated.

5       38. The image sensing apparatus according to  
claim 37, wherein said image signal synthesis means  
synthesizes the plurality of images after changing  
relative positions between the plurality of images on  
the basis of the blurring amounts between respective  
10 pairs of the plurality of images.

15       39. An image sensing apparatus comprising:  
image sensing means for converting an optical  
image into electric signals and outputting the electric  
signals as image signals;  
photometry means;  
luminous exposure adjustment means for determining  
a plurality of luminous exposures to be used in said  
image sensing means on the basis of a photometry result  
20 obtained by said photometry means;  
control means for controlling said image sensing  
means so as to sense an object a plurality of times  
using the plurality of luminous exposures determined by  
said luminous exposure adjustment means; and  
25       image signal synthesis means for synthesizing  
image signals of a plurality of images of the object

outputted by said image sensing means to generate a single image.

40. The image sensing apparatus according to  
5 claim 39, wherein said photometry means performs photometry on each of a plurality of divided areas of an image sensed by said image sensing means.

41. The image sensing apparatus according to  
10 claim 40 further comprising main object determination means for determining a divided area which includes a main object among the plurality of divided areas, wherein said luminous exposure adjustment means controls said image sensing means to use a first  
15 luminous exposure which is suitable for the divided area including the main object, which is determined by said main object determination means, and to use at least one of second and third luminous exposures where the second luminous exposure is larger than the first  
20 luminous exposure and the third exposure is smaller than the first luminous exposure.

42. The image sensing apparatus according to  
claim 39, wherein said luminous exposure adjustment  
25 means adjusts the luminous exposure by changing exposure time.

43. The image sensing apparatus according to  
claim 39, wherein said luminous exposure adjustment  
means adjusts the luminous exposure by changing  
5 aperture of an iris diaphragm.

44. The image sensing apparatus according to  
claim 39, wherein said luminous exposure adjustment  
means adjusts the luminous exposure using an  
10 electrochromic element.

45. The image sensing apparatus according to  
claim 39 further comprising vibration detection means  
for detecting vibration of the image sensing apparatus,  
15 wherein said luminous exposure adjustment means  
determines luminous exposures to be used on the basis  
of a detection result by said vibration detection means.

46. The image sensing apparatus according to  
20 claim 39 further comprising change-over means for  
changing between a plurality of image sensing modes  
which designates the number of image sensing operations  
to be performed for sensing an object by said image  
sensing means,  
25 wherein said luminous exposure adjustment means  
determines luminous exposures to be used in accordance

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with the number of image sensing operations set by said change-over means.

47. An image synthesis apparatus comprising:

5       image signal synthesis means having plural kinds of image synthesis control means for synthesizing image signals of a plurality of images to generate a single image;

10      relationship determination means for determining relationship between the plurality of images; and selection means for selecting one of the plural kinds of image synthesis control means on the basis of a determination result by said relationship determination means.

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48. The image sensing apparatus according to claim 47, wherein said relationship determination means is blurring detection means which detects blurring amounts between the plurality of images.

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49. The image sensing apparatus according to claim 47, wherein said relationship determination means is correlation calculation means for calculating correlation between the plurality of images.

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50. An image sensing apparatus comprising:

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- image sensing means for converting an optical image into electric signals and outputting the electric signals as image signals;
- optical means for forming the optical image of an object on said image sensing means;
- shifting means for shifting an image formation position of the optical image formed on said image sensing means to a plurality of different positions;
- pixel shifting control means for controlling said shifting means to shift the image formation position and controlling said image sensing means to sense a plurality of images at the respective image formation positions;
- image signal synthesis means for synthesizing image signals of the plurality of images outputted by said image sensing means to generate a single high-resolution image;
- blurring detection means for detecting partial blurring due to movement of the object between the plurality of images; and
- image synthesis control means for controlling said image synthesis means on the basis of a detection result by said blurring detection means.
51. The image sensing apparatus according to claim 50, wherein said blurring detection means detects

blurring between the plurality of images by each of a plurality of divided areas of an image sensed by said image sensing means.

5        52. The image sensing apparatus according to  
claim 51, wherein said blurring detection means has  
correlation calculation means for calculating  
correlation between the plurality of images, and  
detects an area where the partial blurring due to  
10      movement of the object occurs on the basis of the  
calculated correlation, further detects a movement  
vector in the area.

15      53. The image sensing apparatus according to  
claim 50, wherein said image synthesis means has a  
plurality of image synthesis modes, and said image  
synthesis control means selects one of the plurality of  
image synthesis modes on the basis of the detection  
result by said blurring detection means.

20      54. The image sensing apparatus according to  
claim 50, wherein, when the partial blurring detected  
by said blurring detection means is larger than a  
predetermined value, said image synthesis control means  
25      prohibits said image synthesis means to synthesize the

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plurality of images in an area where the partial blurring is detected.

55. The image sensing apparatus according to  
5 claim 50, wherein, when the partial blurring detected by said blurring detection means is larger than a predetermined value, said image synthesis control means performs an image synthesis processing on an area where the partial blurring is detected which is different  
10 from an image synthesis processing performed on an area where the partial blurring is not detected.

56. The image sensing apparatus according to  
claim 55, wherein said image signal synthesis means  
15 generates an image in the area where the partial blurring is detected by performing sweeping processing.

57. The image sensing apparatus according to  
claim 50 further comprising display means,  
20 wherein said image synthesis control means controls said display means in accordance with an image synthesis operation performed by said image synthesis means.

25 58. An image sensing apparatus comprising:

image sensing means for converting an optical image into electric signals and outputting the electric signals as image signals;

image sensing control means for controlling said  
5 image sensing means to sense a plurality of images  
within a predetermined period of time;

image signal synthesis means for synthesizing image signals of the plurality of images outputted by said image sensing means to generate a single image;

10 division means for dividing an image into a  
plurality of small areas;

relationship determination means for determining relationship between the plurality of images by each of the plurality of small areas; and

15 image synthesis control means for controlling  
image synthesis operation by said image signal  
synthesis means on the basis of the relationship  
between the plurality of images determined by said  
relationship determination means.

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59. The image sensing apparatus according to  
claim 58 further comprising vibration detection means  
for detecting vibration of the image sensing apparatus  
by detecting uniform blurring between the plurality of  
25 images,

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wherein said relationship determination means is a blurring detection means for detecting movement of the object, and said image synthesis control means controls said image signal synthesis means on the basis of a 5 detection result by said vibration detection means and a detection result by said blurring detection means.

60. The image sensing apparatus according to claim 58 further comprising:

10 vibration detection means for detecting vibration of the image sensing apparatus by detecting uniform blurring between the plurality of images; and  
vibration compensation means for compensating the vibration on the basis of a detection result by said 15 vibration detection means.

61. An image synthesis apparatus comprising:  
image signal synthesis means for synthesizing image signals of a plurality of images to generate a 20 single image;

blurring area detection means for detecting an area where a partial blurring occurs between the plurality of images; and  
movement vector detection means for detecting a movement vector in the area, detected by said blurring area detection means, between the plurality of images.  
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wherein said image signal synthesis means synthesizes an image in the area detected by said blurring area detection means by applying a first method using the movement vector, and synthesizes an 5 image outside of the area by applying a second method without using the movement vector.

62. An image synthesis apparatus comprising:
- image signal synthesis means for synthesizing 10 image signals of a plurality of images to generate a single image; and
- area division means for dividing each of the plurality of images into a first image area where relationship between the plurality of images has a 15 first relationship and a second image area where relationship between the plurality of images has a second relationship,
- wherein said image signal synthesis means performs an image synthesis processing, on the first image area, 20 which is different from an image synthesis processing performed on the second image synthesis area.